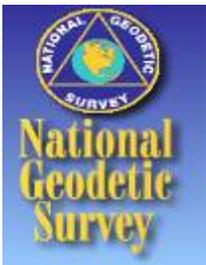


Performance Evaluation of New Orleans and Southeast Louisiana Hurricane Protection System

Strategic Overview



Interagency Performance Evaluation Task Force (IPET)



Agenda

- Strategic Overview – Ed Link
- Data Collection Management and Datum – Reed Mosher & David Zilkoski
- Storm Hydrodynamics and Forces – Bruce Ebersole & Joannes Westerink
- Levee and Floodwall Performance – Reed Mosher & Michael Sharp

IPET Mission

...“to provide credible and objective scientific and engineering answers to fundamental questions about the performance of the hurricane protection and flood damage reduction system in the New Orleans metropolitan area.”

1. The Flood Protection System: What were the design criteria for the pre-Katrina hurricane protection system, and did the design, as-built construction, and maintained condition meet these criteria?

What were the design assumptions and as built characteristics of the primary components of the flood protection system?

What records of inspection and maintenance of original construction and post Katrina repairs are available that document their conditions?

What subsurface exploration and geotechnical laboratory testing information were available as the basis of design, and were these conditions verified during construction?

Were the subsurface conditions at the locations of levee failures unique, or are these same conditions found elsewhere?

2. The Storm: What were the storm surges and waves used as the basis of design, and how do these compare to the storm surges and waves generated by Hurricane Katrina?

What forces, as a function of location and time, were exerted against the hurricane protection system by Katrina?

3. The Performance: How did the floodwalls, levees, pumping stations, and drainage canals, individually and acting as an integrated system, perform in response to Hurricane Katrina, and why?

What were the primary failure mechanisms and factors leading to failure for those structures suffering catastrophic failure during the storm?

What characteristics allowed components of the system to perform well under exceptional loads and forces?

What was the contribution of the pumping stations and drainage system in the unwatering of flooded areas?

What areas or components of the flood protection system have sustained damages that reduce their protection capacity and may need some reconstitution of capacity?

4. The Consequences: What have been the societal-related consequences of the Katrina-related damage?

How are local consequences related to the performance of individual components of the flood protection system?

What would the consequences have been if the system would not have suffered catastrophic failure?

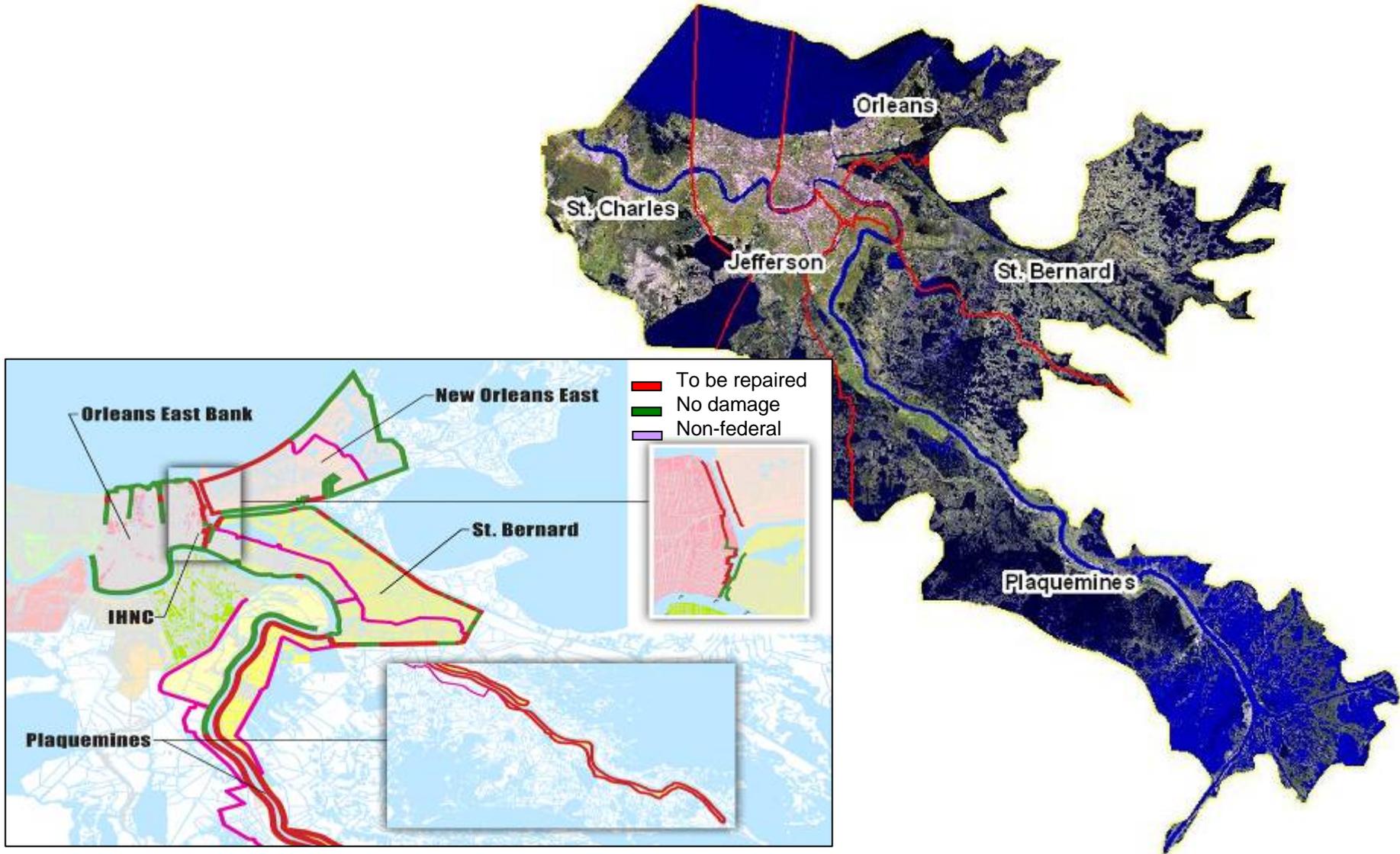
What are the consequences of Katrina that extend beyond New Orleans and vicinity?

5. The Risk: Following the immediate repairs, what will be the quantifiable risk to New Orleans and vicinity from future hurricanes and tropical storms?

What was the risk to New Orleans and vicinity from hurricanes prior to Katrina?

On June 1, 2006, what will be the condition and engineering integrity of the New Orleans hurricane protection system, including structural repairs?

Area of Principal Analysis



Schedule and Milestones

- Initiation of perishable data acquisition – Sep 05
- Formal authorization of Task Force by Chief of Engineers – 10 Oct 05
- SECDEF Authorization of NRC Committee – 19 Oct 05
- Establish External Review Panel – 27 Oct 05
- Public Web Site and first data release - 29 Oct 05
- IPET/ERP Kickoff, New Orleans, 7-8 Nov 05
- ASCE ERP 30% Review – 9-10 Jan 06, Wash DC
- **NRC Committee 30 % Review, New Orleans 17-19 Jan 06**
- ASCE ERP 60% Review – 8-9 Mar 06, Vicksburg, MS
- NRC Committee 60 % Review – 16-17 Mar 06, Vicksburg, MS
- **IPET Structural Performance Evaluation Report – 1 May 06**
- 90 Percent ASCE Review – 4-5 May, New Orleans, LA
- IPET Final Performance Evaluation Report – 1 Jun 06

IPET Report 1: Performance Evaluation Plan and Interim Status

What it IS:

- Strategic Overview and Scopes of Work for IPET activities
 - Incorporates ASCE/ERP and other Views
- Status report on IPET activities for Corps, ERP, Public
- Input to NRC New Orleans Regional Hurricane Protection Committee
- Summary of remaining work to be accomplished, including significant changes or issues based on ERP review or lessons learned.

What it is NOT

- Presentation of findings
- Detailed technical analysis
- Repository of data or analytical products

Table of Contents

- Part I: Introduction
- Part II: Strategic Overview
- Part III: Scopes of Work and Status (By Task)
- Part IV: Appendices
 - History
 - ERP & NRC Panels
 - IPET Communications Plan
 - TFG Support
 - Web Site
 - Data Repository
 - Data Requirements
 - Interim Vertical Datum

Report 2: Status of Analysis (60 %)

Report 3: Structural Performance Evaluation

Report 4: Final Report

Participants: Corps + 40 Organizations

- **Federal Agencies**

- Corps of Engineers (Lead agency)
 - MVD/MVN/MVK/MVS
 - Task Force Guardian
 - Engineer Research and Development Center
 - Huntington District (Task Force Co-Lead)
 - Louisville District
 - Tulsa District
 - Jacksonville District
 - Portland District, Hydropower Design Center
 - Institute for Water Resources / HEC
- FEMA (Team member)
- NOAA
 - NGS (Team Co-lead)
 - CO-OP (Team Co-lead)
 - NWS
 - HRD
- USBR (Team co-lead)
- USDA Economic Research Service (Team Co-lead)
- USGS (Team member)
- NIST

- **State and Local Agencies**

- Louisiana DOT
- New Orleans Levee and Drainage Districts
- South Florida Water Management District (Team Co-lead)
- Harris County Flood Control District, TX (Team Co-lead)

- **International**

- River Bureau, Ministry of Land, Infrastructure and Transportation, Japan
- Geo-Delft, Netherlands

- **Academia**

- University of Maryland (Task Force Lead)
- Louisiana State University
- Jackson State University
- Utah State University
- Penn State University
- University of Florida (Team Co-lead)
- University of Delaware
- University of North Carolina
- University of South Carolina
- University of Norte Dame (Team Co-lead)
- University of Texas
- Stanford University
- Texas A&M U
- University of Wyoming
- Georgia Institute of Technology
- Massachusetts Institute of Technology
- Oklahoma State University
- Virginia Polytechnical Institute and State University (Team Co-lead)
- Villanova University
- RPI
- University of Missouri
- University of Illinois

- **Industry**

- Steedman, Ltd., UK (Team Co-lead)
- Ocean Weather, Inc
- ARA, INC
- CH2M Hill
- RAC Engineering

IPET Teams and Leadership

Task Force	Leader
Project Director	Dr. Ed Link – U of Maryland
Technical Director	Dr. John Jaeger - CELRH
Project Manager	Jeremy Stevenson - CELRH
Team	Co-leaders
Data Collection and Management	Dr. Reed Mosher – ERDC- GSL Denise Martin – ERDC - ITL
Geodetic Vertical and Water Level Datum Assessment	Jim Garster – ERDC - TEC Dave Zilkowski – NOAA/NGS
Storm Surge and Wave Analysis	Dr. Bruce Ebersole – ERDC - CHL Dr. Joannes Westerink, U Notre Dame
Hydrodynamic Forces and Overtopping Analysis	Dr. Don Resio – ERDC – CHL Dr. Bob Dean, U of Florida
Geotechnical Structure Performance Analysis	Dr. Mike Sharp – ERDC – GSL Dr. Scott Steedman – Steedman Ltd
Analysis of Floodwall and Levee Performance	Dr. Reed Mosher – ERDC – GSL Dr. Mike Duncan – Virginia Polytechnical Institute
Interior Drainage / Flooding Analysis	Jeff Harris – IWR – HEC Steve Fitzgerald, Harris County FCD
Pumping Station Performance	Brian Moentenich – CENWP-HDC Bob Howard – South Florida WMD
Consequence Analysis	Dr. Dave Moser – IWR Dr. Pat Canning - USDA
Engineering and Operation Risk and Reliability Analysis	Jerry Foster – HQUSACE Bruce Muller – USBR

Oversight

NRC New Orleans Regional
Hurricane Protection
Committee

<https://ipet.wes.army.mil>

USACE Interagency Performance
Evaluation Task Force

ASCE External
Review Panel

GET THE FACTS

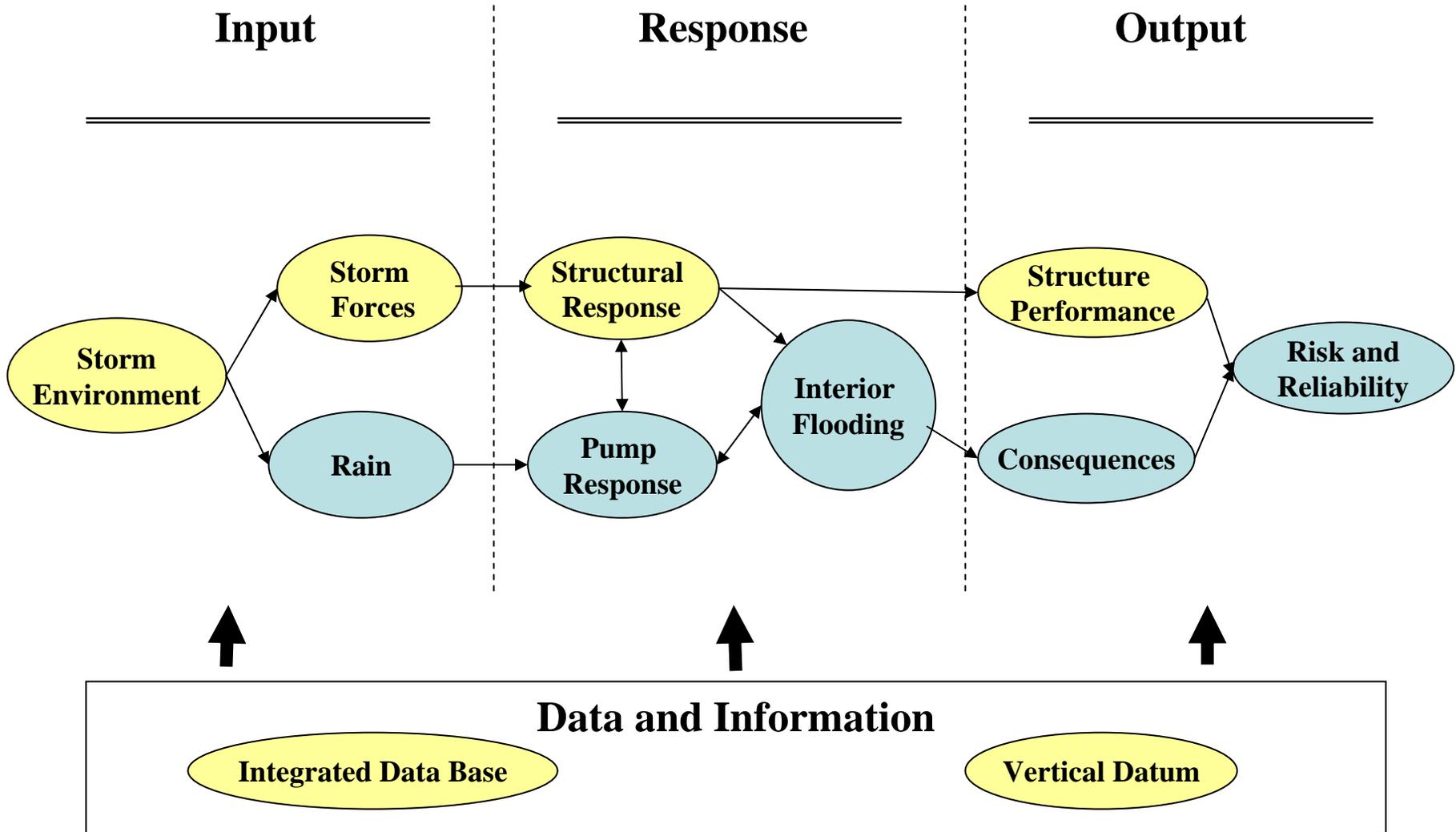
Task Force
Guardian

VERIFY THE FACTS

Examples of IPET support to reconstruction activities in New Orleans

- Coordination of perishable field data collection
- Data Repository
- Public Web Site (tied to TFG e-bid Site)
- Groove Workspace
- Assessment of ASCE/NSF Observations for immediate application in rebuild
- Life cycle documentation of the hurricane protection system (on-going)
- Summary report on Katrina surge and wave elevations (preliminary)
- Summary report on multiple storms/paths surge and wave elevations
- Review of planned repair/rebuild designs
- Evaluation of existing and as-built conditions along canals
- Verification of existing elevations of current and reconstructed protection structures
- Densification of control benchmarks (75 established to date)
 - Interim time dependent vertical geodetic datum
- High water mark surveys

Systems Approach



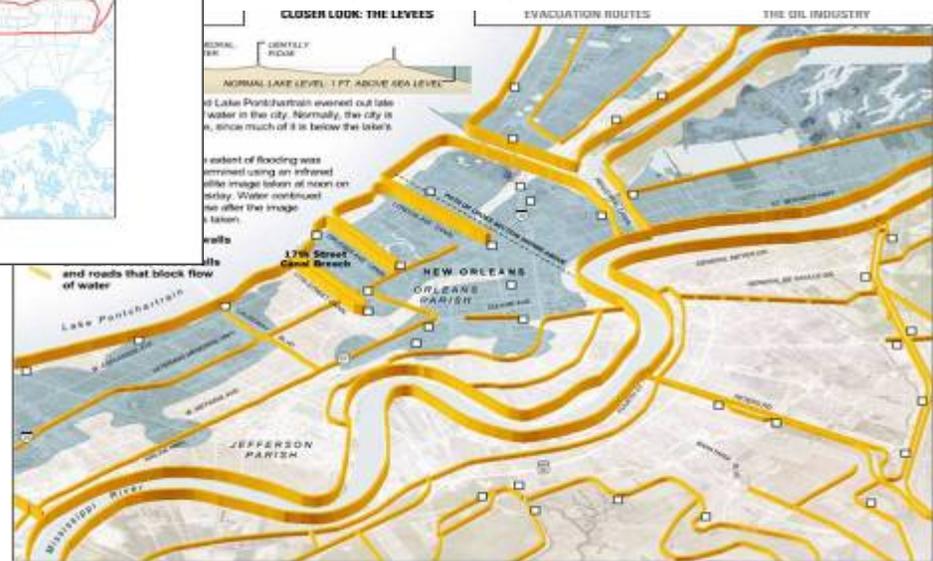
Perishable and Systems Data Collection

Perishable Data



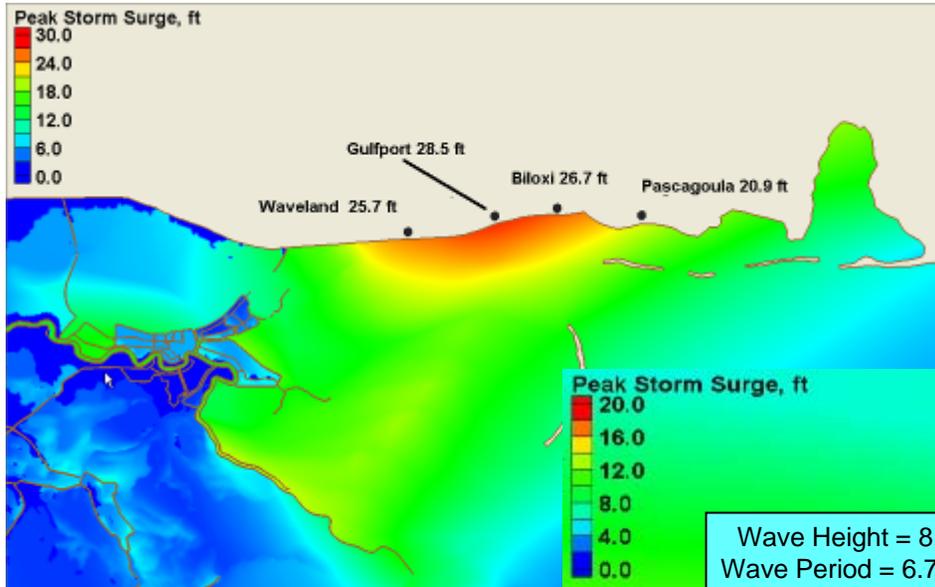
- High Water marks
- Develop accurate vertical datum for area
- Synthesize data collection insights for TF Guardian
- Public Web Site

- Support to NSF, LSU and ASCE Field Data Collection Teams
- Documentation of conditions and structural response
- Collection of geotechnical, design, as-built and condition data
- Validated information repository

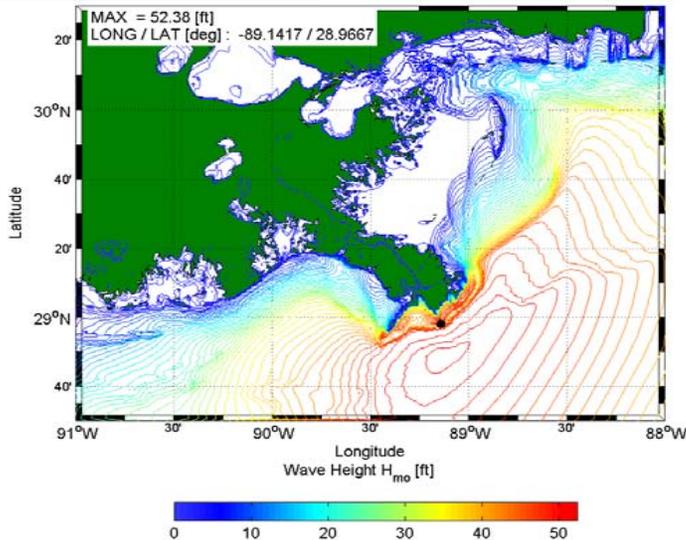
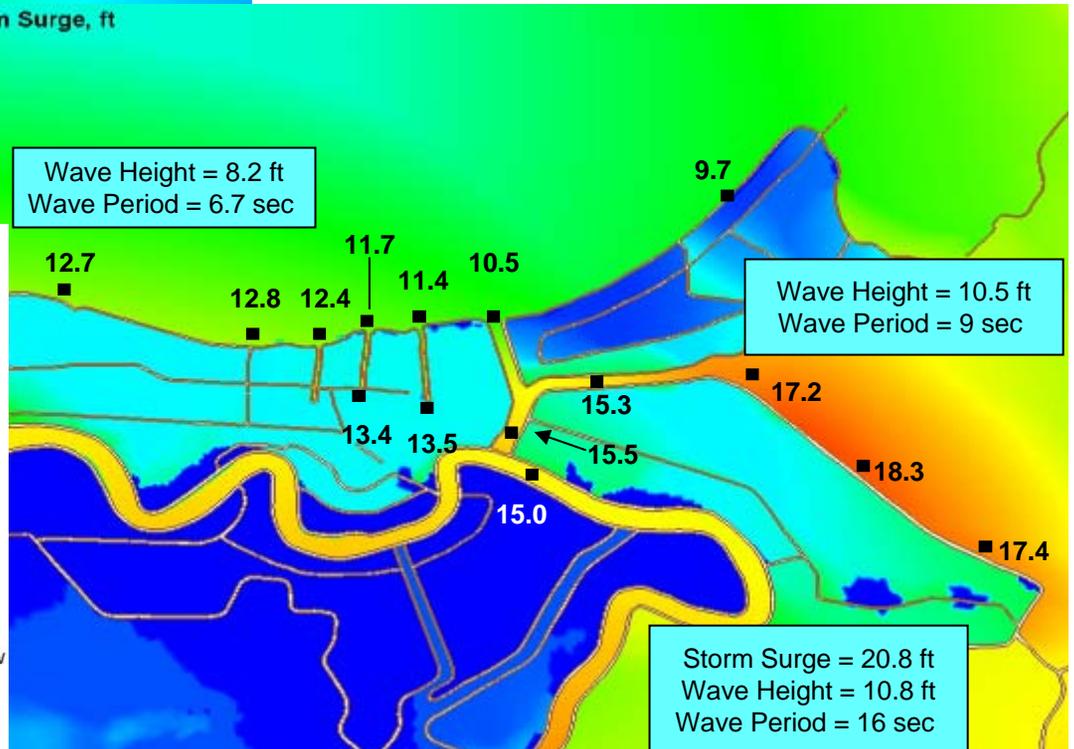


Systems Data

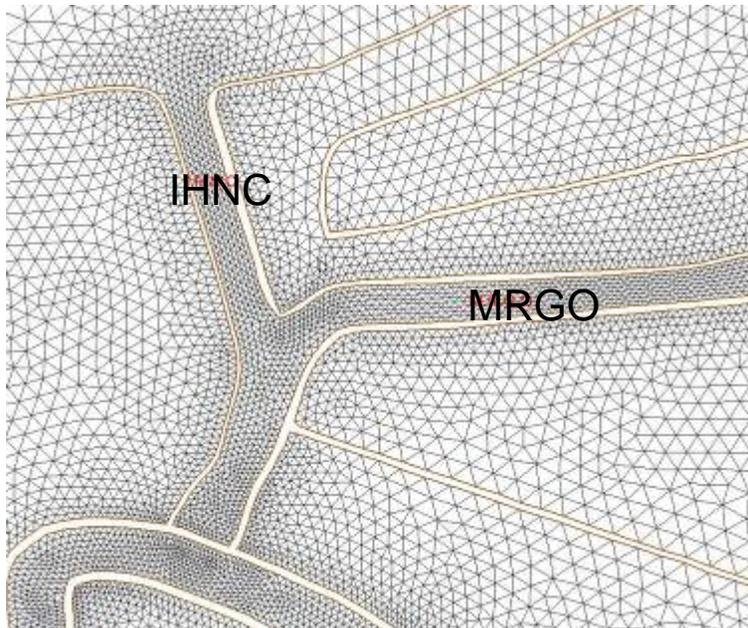
Storm Surge and Wave Modeling



High resolution coupled storm surge and wave models



High resolution modeling of hydrodynamic forces and overtopping



ADCIRC hi-resolution grid for IHNC and MRGO

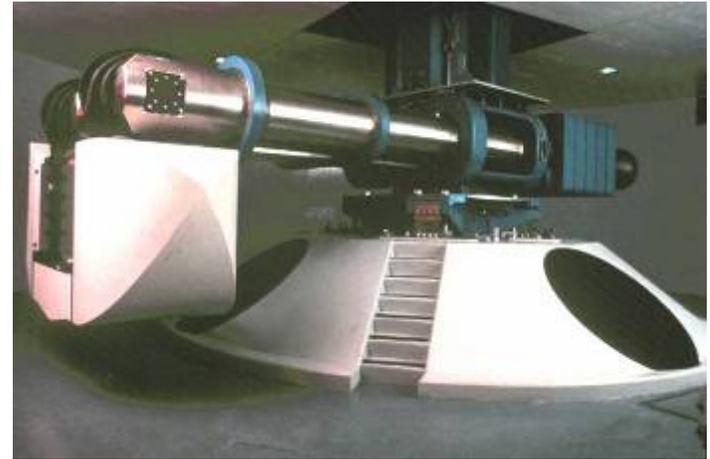


Sample area of interest for detailed physical modeling

Geotechnical Structure Response and Behavior

Combination of numerical and physical modeling

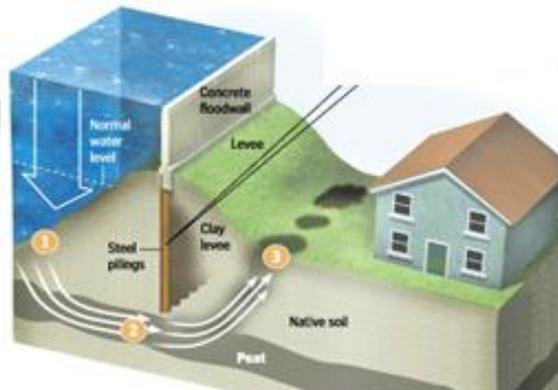
Sophisticated soil-structure analysis will use the Army and RPI centrifuges with support from Geo-Delft



Army Centrifuge



Overtopping & Scour



Piping and Uplift



Weak soil layer

Key Response analyses

Interior Drainage / Flooding



Consequence Analysis

Correlating losses to physical performance by location

Characterization of Losses

Historical/Cultural

Environmental

Health/Safety

Economic

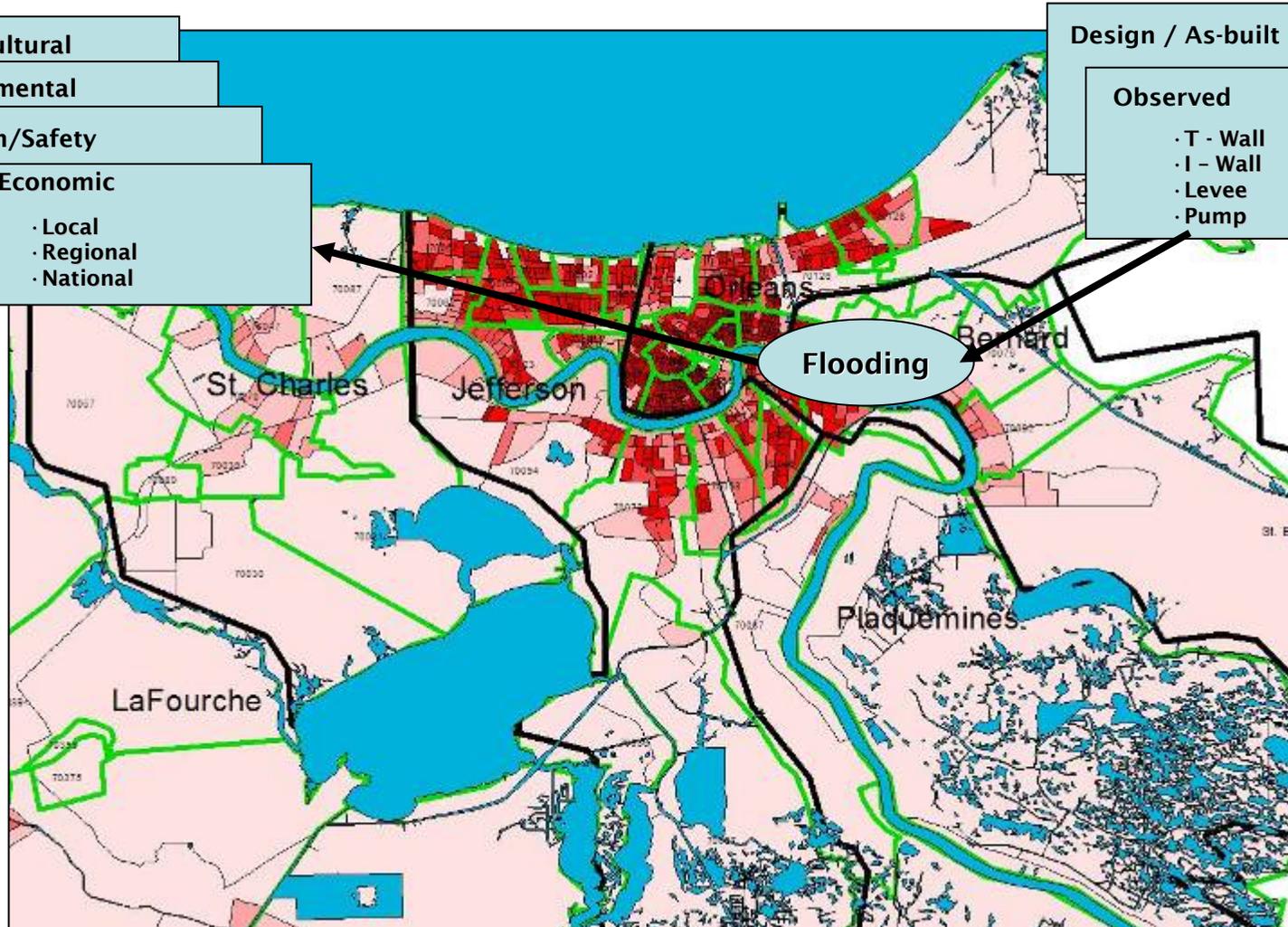
- Local
- Regional
- National

Physical Performance

Design / As-built

Observed

- T - Wall
- I - Wall
- Levee
- Pump

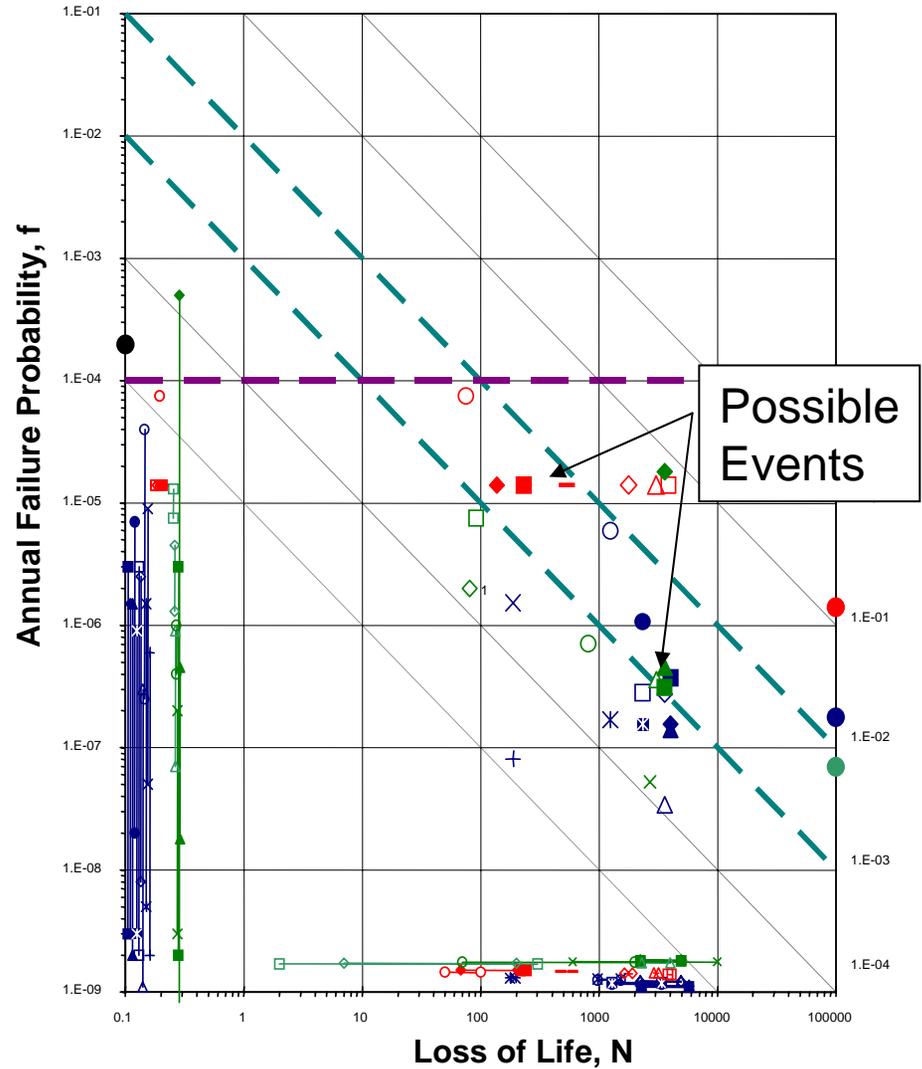


Risk and Reliability Analysis

Variable	Scope
Initiating Events	Katrina, SPH and others
Response (design / actual)	Failed, degraded & successful system performance
Exposure (design / actual)	Interior Flooding
Losses (design / actual)	Type & extent
Risk (geo-referenced)	Before & After Storm

- Public awareness of risk
- Aid Task Force Guardian
- Manage Risk
- Baseline input to Future Planning

Folsom Facility



Static, Seismic, Hydrologic Risk Estimates

Coming attractions

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